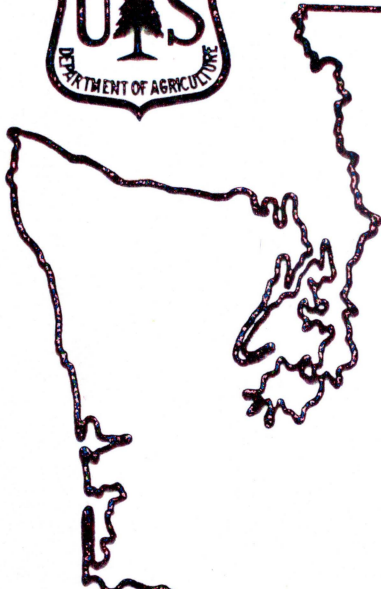


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Forest Pest Management *Pacific Northwest Region*



ROOT DISEASE SURVEY
HIDE-A-BED TIMBER SALE
SALEM DISTRICT
BUREAU OF LAND MANAGEMENT



June 1982

Root Disease Survey of the Hide-A-Bed
Timber Sale, Salem District, BLM

by

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Appreciation is extended to Alan Kanaskie for assisting with this evaluation.

Introduction

On April 20 and 21, 1982, Forest Pest Management personnel did a disease survey of the Hide-A-Bed Timber Sale and adjacent lands, T. 12 S., R. 1 E., sec. 3 W. M., on the Santiam Resource Area, Salem District of the Bureau of Land Management. The Hide-A-Bed Timber Sale includes 41 acres of stands marked for partial cutting and 8 acres to be clearcut. The remainder of the sale area includes 111 acres of timber reserve. The purpose of the survey was to identify portions of stands within the sale area to be considered for post-sale disease management in the form of site treatment or regeneration with less disease-susceptible species and to identify diseased areas and develop management alternatives for an adjacent stand.

The stands within and adjacent to the sale area are of three age classes. The youngest, approximately 30 years old, includes a mixture of Douglas-fir (*Pseudotsuga menziesii*), and western hemlock (*Tsuga heterophylla*). This is the only stand which developed following past logging. The others originated following a fire early in this century. A second age class within the sale area includes 50- to 60-year-old Douglas-fir and western hemlock. A third age class of at least 200-year-old Douglas-fir, western hemlock, and western redcedar (*Thuja plicata*) is intermingled with the 50- to 60-year-old stand. These older trees are found in pockets scattered throughout the stand, especially along the creek bottoms and also as lone remnants elsewhere.

Stands including these two age classes are units marked for clearcut and partial cutting, with larger dominants, especially Douglas-fir, being favored as leave trees.

Methods

A systematic survey of Block A, the 32-acre, 30-year-old stand (Figures 1 and 2), was done by placing plots at two-chain (132') intervals along transects located two chains apart. Each plot was inspected for dead, dying, or symptomatic trees with root disease. Surveyors traveling the transects looked for

diseased trees or centers within one chain of either side. Location along line, distance (from line), center size, and pathogens were recorded.

Root disease symptoms on living trees usually include chlorotic and/or thinning foliage, an abnormal "distress" cone crop, and basal resinosis. Trees killed by laminated root rot, caused by *Phellinus (Poria) weirii*, are often windthrown with a "root ball" due to decay of the root system. Laminated decay can usually be seen on these trees along with pitted wood and setal hyphae characteristic of this disease (Plate 1). Live infected trees will usually have ectotrophic mycelium growing on the outer surface of one or more roots (Plate 2).

Trees killed by *Armillaria mellea*, the shoe-string fungus, are also often windthrown. Signs of this disease are the spongy yellow decay with black zone lines. Black rhizomorphs, string-like growths, also are found sometimes. The most characteristic indicator of this disease is the cream-white-colored mycelial fans which grow under the bark, replacing the cambial layer of infected trees (Plate 3). These usually can be found on trees which have been dead less than 2-3 years.

All plots in the survey were variable radius (40 BAF). Any dead, dying, or symptomatic tree was tallied by species, diameter at breast height (DBH), condition, and disease pathogen. On every fifth plot all trees (including healthy) were tallied by species, DBH, and condition. Heights were measured on a subsample of plot trees for all DBH classes. From data collected in prism plots, mean basal area, number of trees, and volume per acre were calculated by tree species, DBH class, and condition, including disease. Information pertaining to disease found both inside and outside of plots was used to construct a stand map indicating location of disease centers (Figure 2).

The remaining area surveyed included the three harvest units with 41 acres to be partial cut (Blocks B and C) and 8 acres to be clearcut (Block D) and a potential progeny test site (Block E) of about 10 acres (Figure 1). These areas were surveyed using a "walk-through" system. Transects were placed across units at four-chain intervals. With a person one chain on either side of the transect and observing a path one-chain wide on either side, essentially 100 percent coverage was achieved.

Any dead, dying or symptomatic trees were checked for signs or indicators of disease.

Results

Block A

This stand is comprised of second-growth Douglas-fir and western hemlock, approximately 30 years old. A few old-growth remnants remain in the block. The stand is partially out of the contract area. It is not in a harvest unit, but is under consideration for commercial thinning at a future date.

The surveyed block contained a total of 179.8 ft² of basal area per acre including live and dead trees (Table 1). There were 390.7 trees per acre greater than or equal to 4.0 inches DBH (Table 2). Average total volume per acre for the block was 5,145 ft.³ (Table 3).

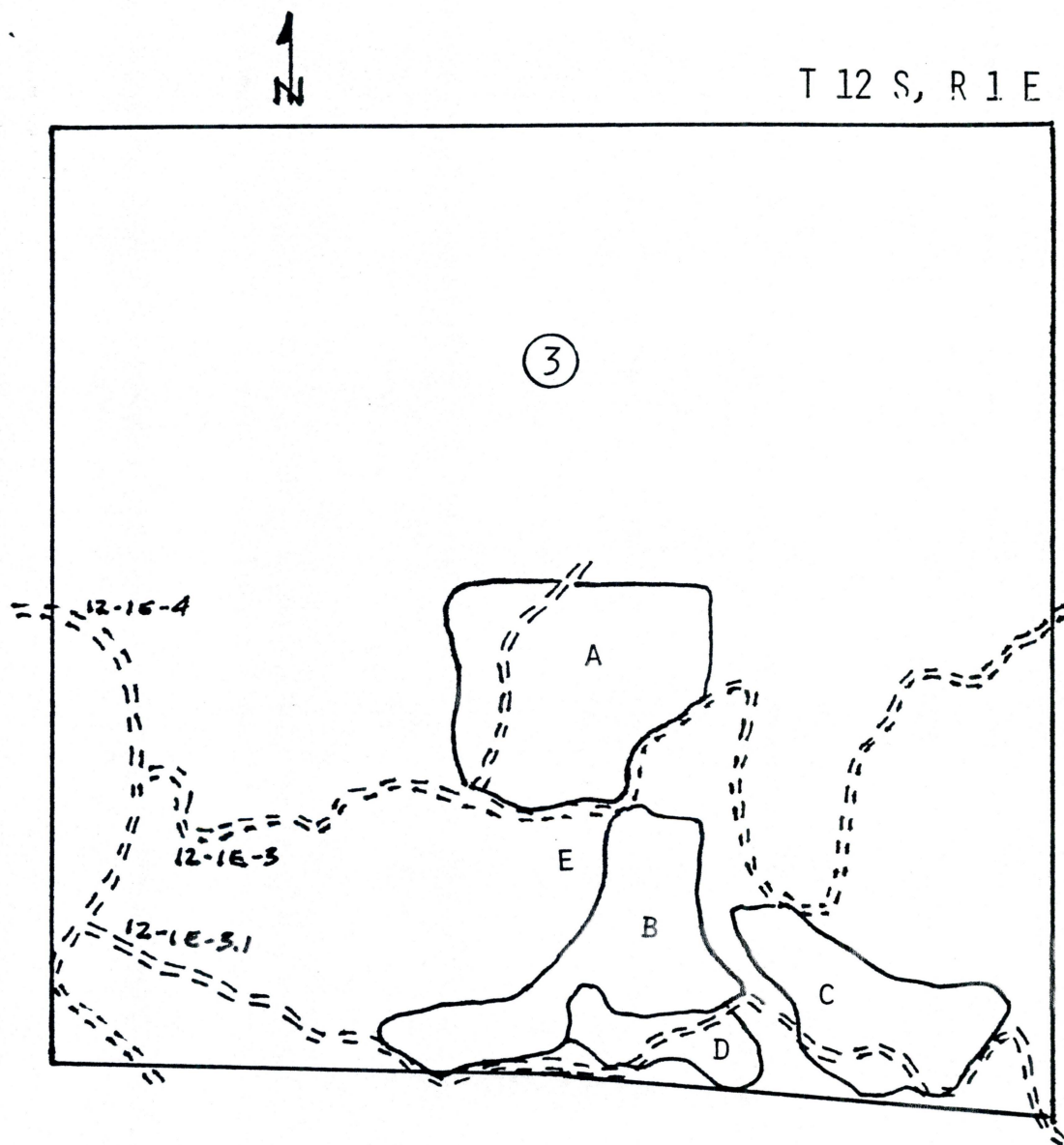


Figure 1.--Areas surveyed in the Hide-A-Bed root disease evaluation. Scale is approximately 1 inch = 1000'.

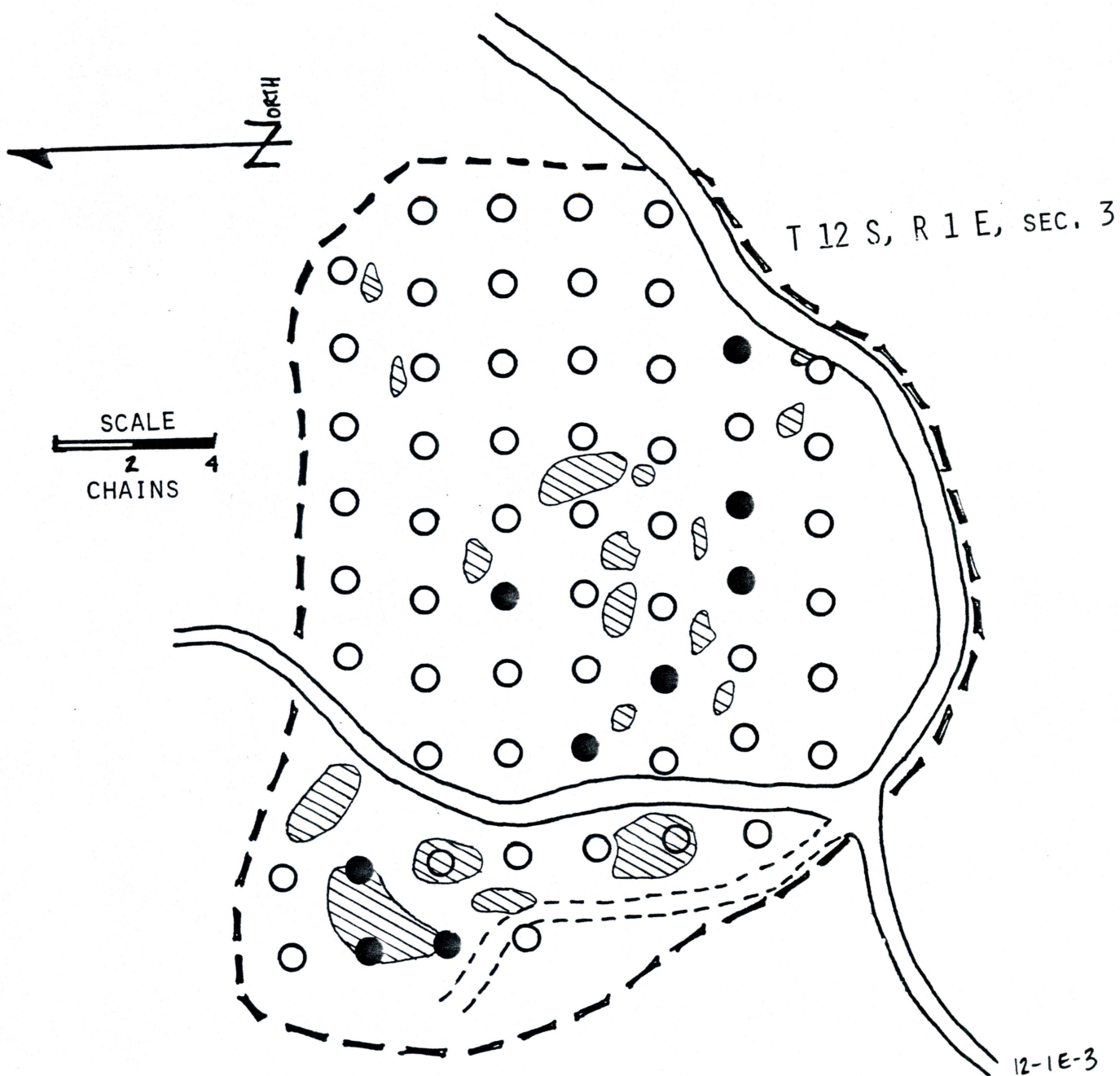


Figure 2.--Location of variable radius plots (BAF 40) in Block A containing living or dead trees infected with *Phellinus (Poria) weirii* (solid dots). Cross hatching indicates disease centers.

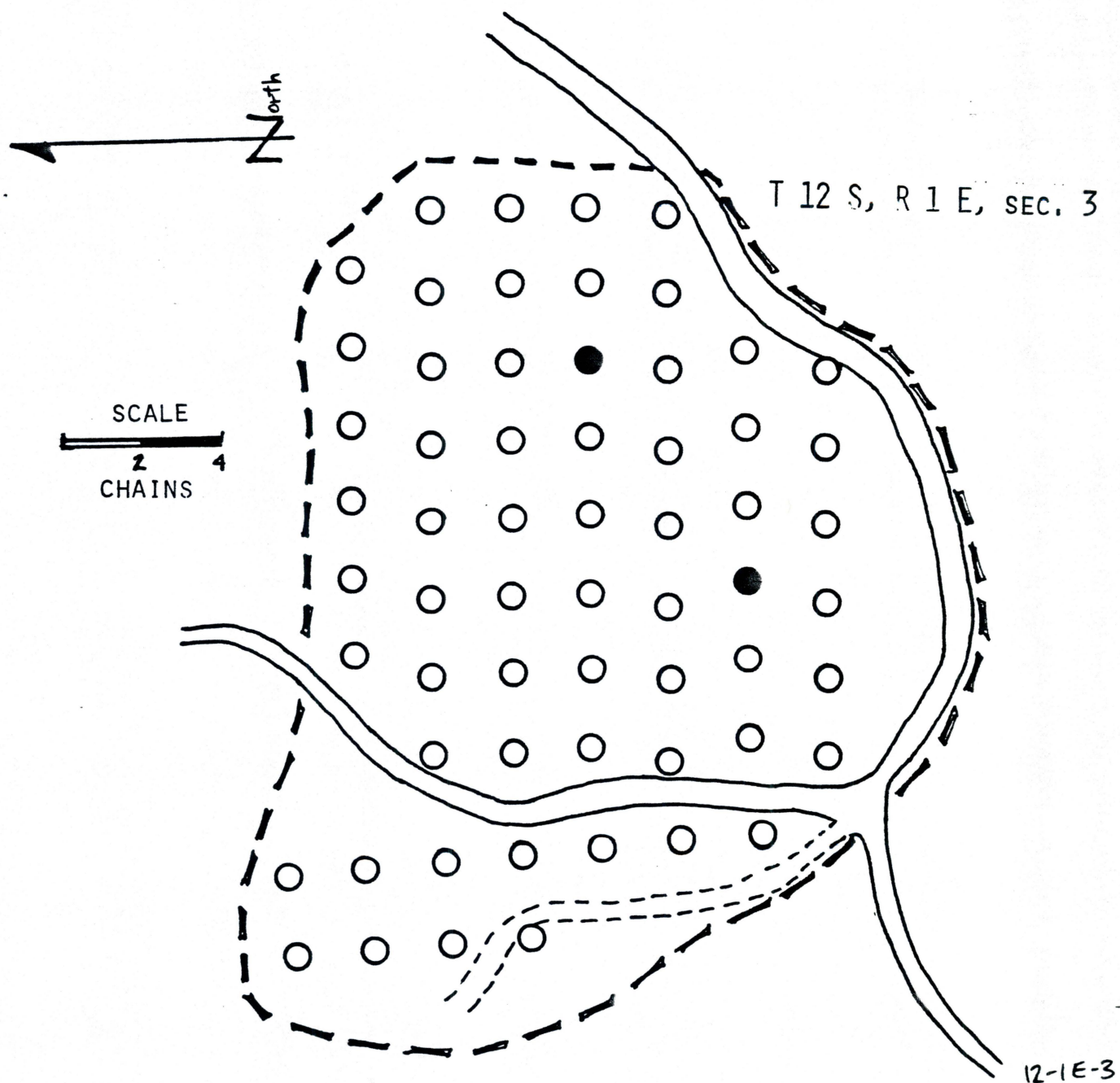


Figure 3.--Location of variable radius plots (BAF 40) in Block A containing living or dead trees infected with *Armillaria mellea* (solid dots).

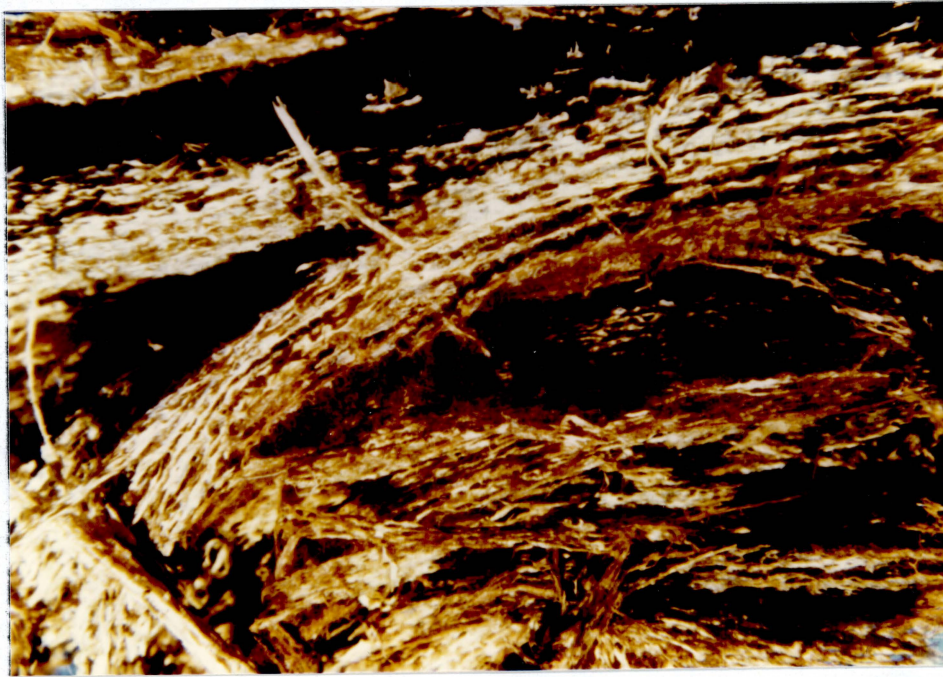


Plate 1. Laminated decay and setal hyphae characteristic of *Phellinus (Poria) weirii*



Plate 2. Ectotrophic mycelium of *Phellinus (Poria) weirii* growing on a Douglas-fir root



Plate 3. Mycelial fans characteristic of *Armillaria mellea*

Laminated root rot was found at nine of the 61 prism points (Figure 2). Distribution of disease centers, also shown in Figure 2, indicates fairly wide occurrence throughout the stand. Volume loss due to laminated root rot-caused mortality currently amounts to 143.2 ft.³ (2.8%) per acre. An additional 185.4 ft.³ (3.6%) per acre is in living yet infected trees (Table 6). Loss is greatest in the larger size classes.

Armillaria root rot was also found causing some mortality in this stand. Figure 3 indicates the location of the two plots containing trees infected with *A. mellea*. Volume loss due to this root rot presently is 32.4 ft.³ (0.6%). Another 54.8 ft.³ (1.0%) is in living infected trees.

Basal area per acre and tree per acre data for both root rots in dead and living, yet infected, trees are shown in Tables 4 and 5.

Block B

This stand is marked for partial cutting in the timber sale. The stand was comprised of 50- to 60-year-old Douglas-fir and western hemlock with a few scattered old-growth Douglas-fir and western redcedar. The "walk-through" survey indicated that this stand is relatively healthy. A minor amount of hemlock dwarf mistletoe (*Arceuthobium tsugense*) was found in one 6- to 8-acre area.

Block C

This stand is also marked for partial cutting. It is comprised of 50- to 60-year-old Douglas-fir and western hemlock. Inspection of this stand yielded a minor amount of laminated root rot which was found on two windthrown Douglas-fir.

Block D

This stand is to be clearcut in the timber sale. It is a mixture of old-growth Douglas-fir, western redcedar, and western hemlock, with a younger understory of 50- to 60-year-old Douglas-fir and western hemlock.

No significant disease problems were found in this unit.

Block E

This is a 10-acre proposed progeny test site which will be used to test various Douglas-fir seed sources for growth. The stand on this site is very sparsely stocked and is dominated by western hemlock and hardwoods. If this site is used, it will be clearcut in a subsequent sale.

An inspection of this area showed no disease problems present in this stand.

Discussion

The most serious disease problem in the surveyed areas is laminated root rot. A small amount of disease caused by *A. mellea* also is present. Block A contains the only significant amount of root rot in the area.

Laminated root rot can cause serious losses in Douglas-fir stands. The host is very susceptible to the disease when its roots contact infected material. Centers develop when neighboring trees are in turn infected and die. By rotation age, disease losses can be very high. The disease can then remain on the site in infected stumps and roots for up to 50 years, posing similar danger to the next rotation.

Recommended control for laminated root rot is to cut all susceptible hosts in disease centers and a 50-foot buffer around each and (1) mechanically remove stumps and large roots from the soil; or (2) harvest trees in the center and 50-foot buffer and plant with less susceptible tree species.

Stump removal is an alternative in Block A. Terrain is gentle and would allow use of track-equipped machinery. This could be done in conjunction with a commercial thin entry. Mechanical removal is, however, expensive and can contribute to soil damage. Species manipulation is probably a more desirable alternative.

In the Hide-A-Bed area, tree species by decreasing degree of susceptibility are: immune-hardwoods (red alder, *Alnus rubra*; big leaf maple, *Acer macrophyllum*;) resistant-western red cedar; tolerant-western white pine (*Pinus monticola*), intermediately susceptible-western hemlock, susceptible-Douglas-fir and grand fir (*Abies grandis*). If only immune species are grown for a rotation (at least 50 years) on an infected site, inoculum in the soil should be sufficiently decayed to be noninfective. Douglas-fir could then be grown on the following rotation without becoming infected. If resistant or tolerant species are grown, there may be a small amount of infection and retention of the pathogen, but virtually no mortality. If intermediate susceptible species are used, many trees may become infected, they could suffer some butt rot and mortality, and the disease will be maintained on the site. A subsequent rotation of Douglas-fir could possibly sustain significant losses. Replanting the site immediately with Douglas-fir would, in all likelihood, result in losses greater than those currently being experienced.

Armillaria caused mortality may well be due to the planting stock used to regenerate Block A. Indications are that off site plantings or other stress-inducing factors can cause susceptibility to this root rot. Losses so far are fairly low and this problem should not occur in future rotations if good planting stock is used. In most West side Douglas-fir plantations, mortality from Armillaria root rot subsides once the stands reach about 25 years of age. Upon final harvest of the present stand the possibility of treating the site should be assessed if losses continue to occur, a large number of stumps could harbor *A. mellea* infection which can infect regeneration in the same way as *P. weirii*.

The small amount of hemlock dwarf mistletoe found in Block B probably spread from an infected old residual which survived the fire which gave rise to the present stand. Western hemlock is the only host present at the site for this species of dwarf mistletoe. Management for dwarf mistletoe control simply includes removing all infected hosts from the site.

Management Recommendations and Alternatives

Block A

Treat the disease centers shown in Figure 2 as soon as a commercial entry is possible. Though actual volume loss caused by laminated root rot in this block looks relatively small now, by the time of a regularly scheduled final harvest 50 years from now, we predict very substantial losses (40 to 60 percent) if the stand is not treated. Clearcuts should be made to include the disease centers and a 50-foot buffer around each. Because of the distribution and size of infection centers, this will result in treatment of a fairly substantial block of land at the center of the stand and virtually all of the area west of the main road. Managers should then consider two treatment options. The first involves stump removal using heavy equipment followed by ripping to rooting depth to remove large roots. Uprooted material can either be left on the surface or piled and burned. Following treatment Douglas-fir can be replanted. The second option involves replanting the centers with immune, resistant, or tolerant tree species (red alder, western redcedar, and possibly rust-resistant western white pine are adapted to the site and would be preferred choices). Subsequent thinning should discriminate against volunteer Douglas-fir if the second option is selected.

The remaining stand could be commercially thinned during this entry, producing revenue to pay for treating the centers and improving growth and vigor of the leave trees, possibly further reducing the hazard of Armillaria root rot.

Block B

Partially cut in the timber sale as planned. The dwarf mistletoe-infected western hemlock are marked for removal and Douglas-fir are being left in the infected area.

Block C

The minimal laminated root rot found in this harvest unit does not yet warrant management action. Upon final harvest at rotation age the situation should be reevaluated and treatment should be considered if warranted.

Block D

Clearcut as planned.

Block E

There was no disease found in this stand. If this site is used for a progeny test site, there should be minimal disease hazard. If stumps are removed to facilitate management, there would be essentially no root rot hazard.

Table 1.--Mean basal area (ft.²) per acre by tree species, condition, and diameter class, Hide-A-Bed Timber Sale.

DBH Class	Douglas-fir		Western Hemlock		Western Redcedar	
	<u>Live</u>	<u>Dead</u>	<u>Live</u>	<u>Dead</u>	<u>Live</u>	<u>Dead</u>
4			3.3		3.3	
6	20.0					
8	20.0	3.3				
10	33.3	2.0				
12	20.0	0.7	3.3	0.8		
14	23.3		6.7			
16	13.3	0.7	3.3			
18	10.0					
20	3.3	0.6				
22						
24						
26						
28		1.3				
30		0.7				
32						
34						
36		1.3				
38						
40		3.9				
42						
44						
46		0.7				
48		0.7				
Total	143.2	15.9	16.6	0.8	3.3	
Grand Total						179.8

Table 2.--Mean number of trees per acre by species, condition, and diameter class, Hide-A-Bed Timber Sale.

DBH Class	<u>Douglas-fir</u>		<u>Western Hemlock</u>		<u>Western Redcedar</u>	
	<u>Live</u>	<u>Dead</u>	<u>Live</u>	<u>Dead</u>	<u>Live</u>	<u>Dead</u>
4			38.3		38.3	
6	101.9					
8	57.3	9.4				
10	61.1	3.6				
12	25.5	0.8	4.2	1.0		
14	21.8		6.2			
16	9.6	0.5	2.4			
18	5.7					
20	1.5	0.3				
22						
24						
26						
28		0.3				
30		0.1				
32						
34						
36		0.2				
40		0.5				
42						
44						
46		0.1				
48		0.1				
Total	284.4	15.9	51.1	1.0	38.3	
Grand Total						390.7

Table 3.--Mean volume per acre (ft.³) by species, condition, and diameter class, Hide-A-Bed Timber Sale.

DBH Class	<u>Douglas-fir</u>		<u>Western Hemlock</u>		<u>Western Redcedar</u>	
	<u>Live</u>	<u>Dead</u>	<u>Live</u>	<u>Dead</u>	<u>Live</u>	<u>Dead</u>
4			115		61	
6	469					
8	501	82				
10	904	53				
12	558	18	109	23		
14	643		225			
16	413	22	110			
18	308					
20	102	20				
22						
24						
26						
28		44				
30		18				
32						
34						
36		55				
38		179				
40						
42						
44						
46		56				
48		57				
Total	3898	604	559	23	61	
Grand Total						5145

Table 4.--Mean basal area per acre (ft.²) by disease, condition, and diameter class, Hide-A-Bed Timber Sale.

DBH Class	Living Diseased Trees With:		Dead Trees With:	
	<u>Phellinus</u> <u>weirii</u>	<u>Armillaria</u> <u>mellea</u>	<u>Phellinus</u> <u>weirii</u>	<u>Armillaria</u> <u>mellea</u>
4				
6	0.7	0.7	0.7	
8		0.7	1.3	1.3
10	0.7		1.3	
12	2.0		1.3	
14	2.0	0.7		
16	1.3	0.7		
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				
42				
44				
46				
48				
Total	6.7	2.1	5.3	1.3
Grand Total				15.4

Table 5.--Mean number of trees per acre by disease, condition, and diameter class, Hide-A-Bed Timber Sale.

DBH Class	Living Diseased Trees With:		Dead Trees With:	
	<u>Phellinus</u> <u>weirii</u>	<u>Armillaria</u> <u>mellea</u>	<u>Phellinus</u> <u>weirii</u>	<u>Armillaria</u> <u>mellea</u>
4				
6	3.6	3.6	3.6	
8		2.0	3.7	3.7
10	1.3		2.4	
12	2.5		1.7	
14	1.9	0.7		
16	0.9		0.5	
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				
42				
44				
46				
48				
Totals	10.2	6.3	11.9	3.7
Grand Total				32.1

Table 6.--Mean volume per acre (ft.³) by disease, condition, and diameter class, Hide-A-Bed Timber Sale.

DBH Class	Living Diseased Trees With:		Dead Trees With:	
	<u>Phellinus</u> <u>weirii</u>	<u>Armillaria</u> <u>mellea</u>	<u>Phellinus</u> <u>weirii</u>	<u>Armillaria</u> <u>mellea</u>
4				
6	16.6	16.6	16.6	
8		17.5	32.4	32.4
10	19.2		35.5	
12	54.8		37.2	
14	56.1	20.7		
16	38.7		21.5	
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				
42				
44				
46				
48				
Totals	185.4	54.8	143.2	32.4
Grand Total				415.8

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